Menlo Park Notebook #70 [N-80-01-02.2]

This notebook covers the period January-March 1880. Most of the entries are by Charles Batchelor. A few entries are by Edison. The name Martin Force appears occasionally as a witness. Most of the material relates to the development of the carbon filament lamp. Included are notes, calculations, and drawings of filaments and clamps; drawings and notes on carbon molds; notes and drawings relating to a series of carbonization experiments; and a few notes and drawings of dynamos. The book contains 192 numbered pages followed by 12 unnumbered pages. The pagination is irregular. In the first part of the book only the right-hand pages are numbered; for pages 94-116, only even numbers are used. A few pages near the middle of the book lack numbers.

Missing page numbers: 125, 135, 178.

No 70

16.30

1~~200~~
~~50~~

6~~0,0~~00

16.30 1600

1600 1600 1600 1600 1600

1600 1600 1600 1600

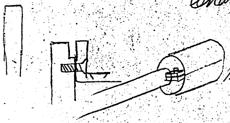
1370
365
6850
8220
4110
~~4~~500.50
50.00.50

[illegible] 76 950.00

New Commutator Jan 2d 1880

1

Chas Batchelor



TAE

M N Force

No 70

16.30

12.00

60,000

16.30 1600

1600 1600 1600 1600 1600

1600 1600 1600 1600

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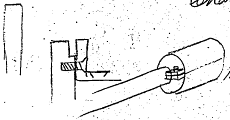
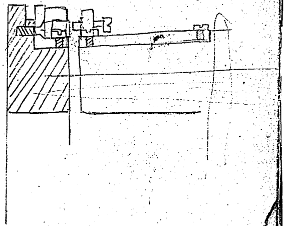
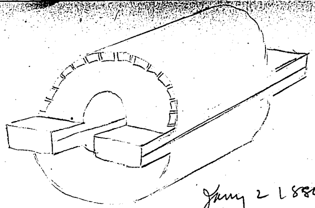
New Commutator Jan 2nd 1880
Chas Batchelor



TAE
M N Force





Jany 2 1880
TAE
Chas Batchelor
M N Force

Lamp. Cost of clamps and wire

Weight of
10 pair of clamps } 6·975 gr
and wires

Cost of Platinum $5 per oz.

10)6·975
·6975 weight of platinum
in one lamp ———·———·—

TAE

Chas Batchelor

Martin N Force

27·2
3 67 6·7

3·03
·005
·01515
·03030

1·82
·025
910
364
·04550

182

3·03
·03
·0909
·1818

182
·005
·00910

3·03 X ·03 X 2 = ·1818
3·03 X ·005 X 2 = ·0303
·2121

·00910
·01820

1·82 X ·025 X 2 = ·0455
1·82 X ·005 X. 2 = ·0091
·0546

·0910
·0182
·1092

·027
·071

1·82
·025
910
364
·04550
·09100

4·20
·12

·2121

3·03
·02

·036

3·03
·02
·0606

3·03
·025
1515
606
·07575

Lamp Carbons : Jany 2 1880

~~Size of our horse Shoe after Carbonizing~~

T A E
Chas Batchelor
M. N. Force

wrong – 3·03 X ·~~03~~ ·02 X ·005
Actual Surface ·2121 inch should be ·1515

Size of ring Carbon made from Same paper

1·82 X ·025 X ·005
Actual Surface ~~[illegible]~~ inch
·1092

4·20 X ·03 X ·009 Before Carb
3·03 X ·02 X ·005 After Carb
Surface before ·3276
" " after ·1515

Given Jany 2 1880
TAE

20 Cells of 2 Volts each and
.2 ohms resistance
What is best way of putting
them for heating platinum
4 3/4 long and .04 resistance
.12 hot

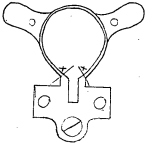
20 Cells Intensity	Total Volts	17.111	Outside	498
10 " of 2 quantity	"	15.413		1680
5 " of 4 "	"	11.100		36.00
4 " of 5 "	"	10.011		4296

Chas Batchelor

M. N. Force

Cutting mould for carbon 2/3 the length of the other one and to be made from paper .0065 instead of .009

Jany 2 1880
TAE



Jan 3rd 1880
Chas Batchelor
M N Force

Length from × to ×	2.65
Width when cut	.13
thickness	.0065

Jan

This will make lamps of 100 ohms and 2/3 surface of ordinary "horseshoe"

Jany 2 1880

New Commutator

TAE Chas Batchelor

1 Must be split and held together by two rings

2 Must be separate from the part that the wires are soldered to

3 The commutator must fit into a recess and bolt to the part that the wires are fastened to by three bolts

4 The brushes must be twice as wide and consequently the Commutator twice as wide

5 Commutator brushes must both be fastened to a circle having the centre of

TAE

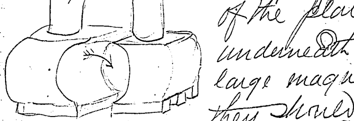
shaft for its centre and both
move together by a handle on
top

6 End brushes must be tried

Jan 9th 1880

Chas Batchelor

Edison says that as
regards the cutting ~~of~~
of the plate
underneath the
large magnets
they should



only be grooved on one side
so as ~~to~~ allow the air to
be drawn in and taken
round the armature —

$\frac{1}{4}$ inch Circle clamps

.1875

Jan 9 1880

~~Tag~~

.25
3.14
100
25
75
.7850
.11875
.5975

.5975
.025
.017925

.5975
.025
29875
11950
.0149375
.0149375
.0298750
.0059871
.0358521 Surface

.5975
.065

1

0149375

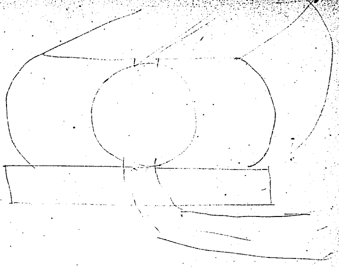
$\frac{1}{4}$ circle with $\frac{3}{16}$ out for Clamps

.2121 ÷ .036

.036) .2127
4) 212
9) 53
$5\frac{8}{9}$

.036
6
.216
4
.212

That is $5\frac{8}{9}$ of these to one of our regulars.



TAE

Jany 9 1880

Chas Batchelor

$C = \frac{E}{R}$ 100

$3000 \times 30 \times 5 =$

$$\begin{array}{r} 3000 \\ 30 \\ \hline 90000 \\ 5 \\ \hline 450000 \end{array}$$

$$\begin{array}{r} 4 \\ 4 \\ \hline 16 \\ 12 \\ 3000 \\ \hline 36000 \end{array}$$

36 $4 \,/\, 450$

$ 112$

$ 12\frac{1}{2}$

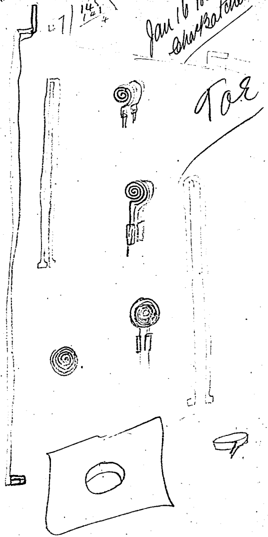
I R R

E.M.F. = □ inch

7 | $\frac{145}{141}$ 4 | 30

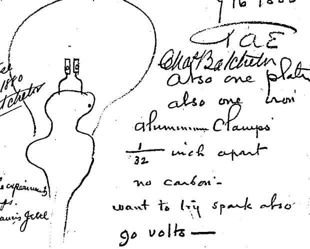
Jan 16 1880
Chas Batchelor

TAE



Experiments January 16 1880

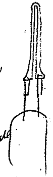
TAE
Chas Batchelor



Made these
Jan 17th 1880
Chas Batchelor

tried the experiments
on the pumps.
Francis Jehl

also one platina
also one iron
aluminum Clamps
$\frac{1}{32}$ inch apart
no carbon-
want to try spark also
90 volts —

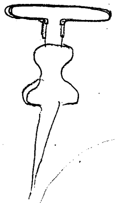


Made this
Jan 17th 1880
Chas Batchelor

tried this
Francis Jehl

Carbon this shape

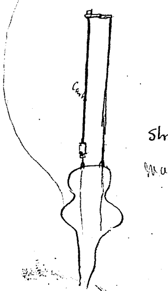
TAE



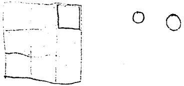
Made this Jan 17th 1880
Chas Batchelor

Carbon this shape

TAE



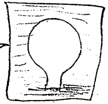
Straight Carbon
Made this Jan 20th 1880
Chas Batchelor



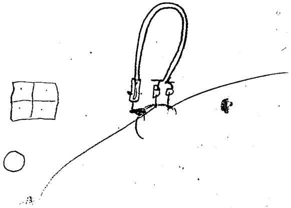
Jan 16 1880

Chas Batchelor

TAE



9/16



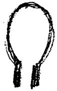
Gene Jan 16' 1880

TAE

Make 6 lamps with 20% Plat. Irid clamps and wire and screws – old thickness – so as to get more pressure

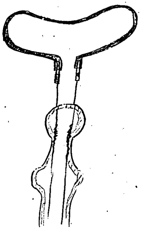
Jan 16. 1880

Leave the Carbon like this; that is with longer shanks



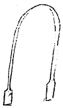
Made so:-
Chas Batchelor

Made these
Jan 17th 1880
Chas Batchelor



Jan 23th. 18

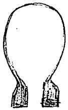
Make one



Carbon turned edgeways

Made Jan 23d 1880
Chas Batchelor

Make loops ordinary size and large base lugs on



Made Jan 24 1880
Chas Batchelor

Make some loops of Card with ~~soaked in~~ Tar rubbed over them ~~Carbon~~, well in, and then cut the loops regular size

Edison vs Maxim vs Swan
Edisons Exhibit S for identification
Dec. 27, 1883
W.H. Kenyon Notary.

Edison's Exhibit E.D. page 37 book
J. F. K.
Notary

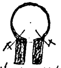
Jan 23rd 1880

Get piece 9 thousandths card and cut 1in X ½" and put between Steel plates and put on as much pressure as possible in press see difference in thickness also in length and width

Before pressing 1in X ½ X ·0095
After pressing

Jan 23rd 1880

Make loops of bank note paper 3 thousandths so as to measure 100 ohms same as other loop



Length from x to x
1.3 inch

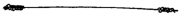
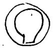
These were tried and gave a gas jet with so small an amount of Energy that it would take 22 for a HP

Chas Batchelor

Make loops of Manilla Hemp fibre -
750 Ohms when cold
Gives us excellent light
540 when hot
This gives light equal $\frac{1}{4}$ gas jet and ~~[illegible]~~ equals 64 per HP.

Chas Batchelor

Jan 24th 1880

Took Manilla hemp and knotted thread  on ends so:- then pressed it between smooth vise and carbonized in carbon  with hole in

Chas Batchelor

Jan 24th 1880

Made loops of Manilla paper 6 thousandths - pressed -

Made these:

Paper before pressing ·0055
" after " ·0040

Chas Batchelor

Took some of the 6 thousandths paper and put under pressure of three men on screw press; this reduced the thickness to 4½ thousandths in place of 6 thousandths — when Carbonized these were particularly straight

Before pressing ·006
After " ·0055

Have Made 12 of these Jan 28th 1880

Chas Batchelor

Jan 24 1880

Make loop of 'Bank note' 3½ thousandths — pressed — and circle $\frac{1}{3}$ larger than loop on page 41

Before pressing ·0035
after —

Jan 24 1880

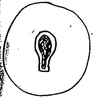
Make two more loops same as shewn on page 41 but have the bank note paper pressed

Made these and numbered

Chas Batchelor

Jan 27th 1880

Made some loops of Manilla hemp fibre & single fibres with tissue paper rolled up on the ends and pressed hard on to the wire this carbonized in chamber &c:-
with former on inside



Chas Batchelor

.015 3
.045 45 | .210
.225 \ 5

.3

2

Jan 30 1880

Made three lamps with
Manilla hemp — the~~se~~ ends
covered with ~~tarred Lampblack~~
~~flattened out~~
These were 2 inch long and
6 by thousandths thick

Chas Batchelor

Jan 20th 1880

Made 3 lamps of hemp
~~[illegible]~~ (Manilla) soaked in
~~Linseed~~ olive oil - The ends made of
paper tightly twisted round
and flattened out -
Paper was also soaked in boiling
Linseed oil

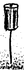
Chas Batchelor

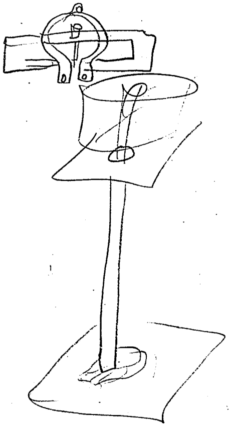
Feb 1st 1880

Made hemp fibres with clamps of plumbago, Graphite such as used in leadpencils — they have got too much stuff mixed with them for us — Seem to swell up and form gases or arcs which bust up the lamps.

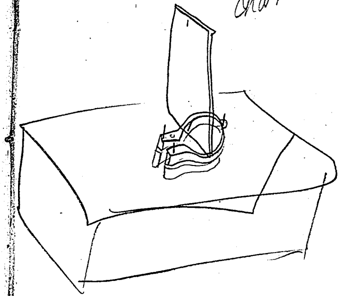
Chas Batchelor

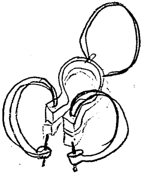
Clamps made for these were just a cylinder of graphite with hole to push on wire and holes in top for carbon loop





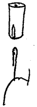
Feb 1st 1880
Chas Batchelor





Feb 3 1880

Made Carbon clamps of Wallace Carbons 1/16 thick — slotted the bottom and doubled the wire and pushed on so:—



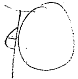
Chas Batchelor

Portland

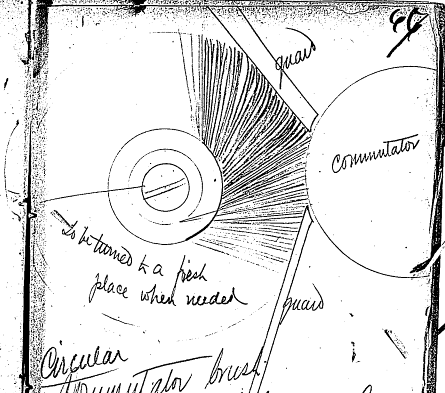
Portland

Portland

Constitutionally



Make with coil spring inside
so as to turn a little itself
if wears away fast


guard
Commutator
To be turned to a fresh
place when needed
guard

Circular
Commutator brush

Chas Batchelor
Feb. 4th 1880

//////

75 - $\qquad$ / $\qquad$ .24

$37\frac{1}{2}$ - hour $\qquad$ 48

19 - $\qquad$ .96.

$9\frac{1}{2}$ - $\qquad$ 192

* $7\frac{1}{2}$ men

$7\frac{1}{2}$

35 $\qquad$ $7\frac{1}{2}$

5

$37\frac{1}{2}$

15

$$\begin{array}{r} 25 \\ 10 \\ \hline 250 \\ 30 \\ \hline 7.500 \end{array}$$

7.50.

775.

$\dfrac{27\frac{1}{2}}{1000}$

$\frac{3}{100}$ wide

$\frac{5}{1000}$ thick

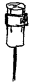
3 inches long

Feb 4 1880

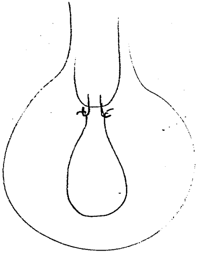
Chas Batchelor

Make Lignum Vitæ Clamps

So:—

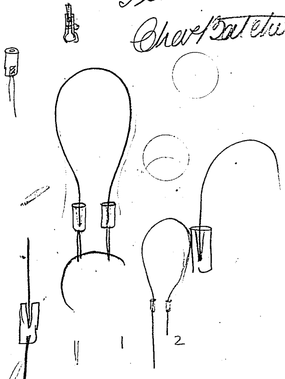


Turn them – Saw them – drill them and after carbonizing ream them out a little so as ~~to~~ clamp the loops about 1/32 of an inch



Feb 1st 1880

Chas Batchelor



Graphite Clamps for Carbons

Feb 4 1880

Chas Batchelor

2 pieces of Cocoa nut Shell
cut $\frac{6}{10}$ long and $\frac{11}{100}$ thick
after carbonizing were
$\frac{44}{100}$ × oval $\frac{6}{100}$ one way
and $\frac{8}{100}$ ~~the other~~

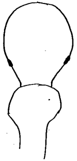
Before ·60 × ·11 circular — fracture glassy
After ·44 × ·06 and ·08 oval — breaks hard

2 pieces Lignum Vitæ
Before ·60 × ·11 circular } fracture
After ·46 × ·08 circular } dense

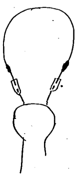
2 pieces Iron Wood
Before ·60 × ·11 circular
After ·45 × 7 a little oval
fracture dense - breaks easy

Carbonization:-

Feb. 8th 1880



Made lamps of Manilla fibre
and cocoa nut clamps —
the clamps pushed onto the
platina wires after carbonization



Afterward made them with the platina wires set in the cocoa nut shell clamps previous to clamping — The wires leading from the glass were flattened out and two holes punched in it and the platinum wires from fibre threaded through ~~so~~ after this the flat Platinum was flattened out clamping the wires tight

Chas Batchelor

282 | 4200 | .22
564
1560
1460

42 | 282

282
.22
564
564
62.04

282

.019 | 192
228

19228
17

Carbonization

Cocoa nut fibre shrinks by carbonization

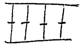
Before 2.82 inches
After $\underline{2.10}$
$\underline{.72}$ or 25 p/c.

Therefore Cocoa nut fibre shrinks in Carbonization $\frac{1}{4}$.

Tried thick and thin fibres

Chas Batchelor

Rice Straw shrinks by carbonization 12% —
in length ~~and thickness~~



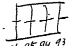
3/100 vat. $\frac{1}{25}$ of ahm.

44
16
264
44
704.

33)704.(21 1/3 foot og.
66
44.
33
11.

)21 1/3

1/2	42 2/3
1/4	85 1/3
1/8	170 2/3
1/16	341 1/3



21
25
105
42
16)525(33.
48
45
32
13

2.ft lb.

25
2
50

-9%

39)

1000 | 39

39) 1000 (26
78
220

26 mm in an inch

16) 27 (1.7
16
110
93

79

1.7
1.7) 13.5
119
160

1.7
1.7
119
17
2.89
1.7
1943
289
4.83 3
7.9
392
336

4 | 37.5
9
28

39.4) 1000 (25.4
788
2120
1970
1500

16 | 25.4 mm in inch
16
94
80
140

1.57
8
12.48

1.57

12.48
2.46
7462
4992
2496
30.6982 .06
7.1

1.57
1.57
1099
785
157
2.4649

~~1~~ cu cent = .06

1000 cu mm = .06

1 cu. mm

.1 cu. inch =

2.46
1.57
1722
1130
246
3.7622

$\pi \frac{D^3}{6}$

250 mm. π π. D [illegible]

π. 2[illegible] α 250 3.14)250.0(80
2512

80 mm
80 mm
6400,000
6 (1,600,000
266 260

80
80
~~6400~~
6400

250 mm

20.5 mm

3.14)2050(65
1884
1660

$14432\overset{7}{0}$

65
65
325
390
4225
205
21125
8450
6)86.6125
14432

.139000

24
9
216

216
139000

```
216 |139000
     1296
       940
       864
       960
```

(~~5~~643

1
643

1
x

643
9
5787

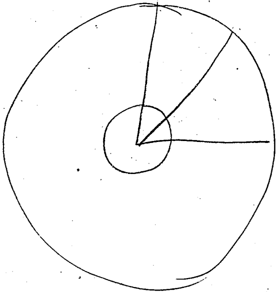
Feb. 12th 1880

Lamp.

No. 649

[redacted] - 650

651



Lamps. Feb 12th 1880

652 } Two small loops paper
653 } lamps made from
$\frac{.15}{1000}$ paper but of high
resistance 300 ohms however they
must be put on pumps
to see whether they come
down further -

Chas Batchelor

654 } Two large loops cut
655 } from regular mould but
off the .015 M paper measuring
600 ohms - not being able
to account for such high
resistance we put them
on the pumps Chas Batchelor

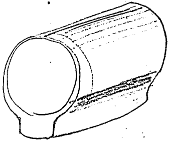
270
70
300

Feb 13 1880

Size of Carbon cut from original former on the new uncalendered 13 thousand paper.

2.85 X .02 X .005

Chas Batchelor



Lamps

Small loops

656 }} Made from paper .015
657 } uncalendered — and as they
are about 600 ohms we
put them on pump to
see if they will come ^
down

Feb 13th 1880

Chas Batchelor

658 Small loop + 300 R —
coated all over with
Alumina finely powdered
and mixed with Alcohol
— put on with brush —

Feb. 13th 1880

Chas Batchelor

M

26/78

.028 5

.014

14 M
4
10

3.00
.78
2.22

2.22 X .01

.01
3.1
01
03
.031
2.22
62
62
62
~~.06882~~

2

4.00
1.04
2.96

.14

4 in X .014 would be 2.96 X .01 = 100 ohms

.031
2.96
186
279
62
.09176

N

~~.0045~~
8 X .014 would be right

21

~~8 of 4 20~~ ——— 14
8 of 20 N Resis. 100

.0175

.020
3.14
80
20
60
.06280
8
.50240

~~25~~

Lamps: Feb. 13th 1880 96

659 Small loop made from .015 Uncalendered paper — to be blown in large bulb. for experiment — High resistance ——

Chas Batchelor

---

660 - Bass fibre — 3 in long .014 thick nearly round Shrinks. 26/78 — Resist 7/8 ohms

Actual surface for lamp .069 inches

Actual length 2.22 X .01 round —

300 | 55.0 (0.18
300
2500
2400

300 | 77.0 (0.26
600
1700

223

Lamps

661 Cocoa Matting —
Before Carbonizing was
3·X ·028 X ·013
One cocoa nut clamp.
One Lignum Vitæ clamp.

Cocoa Matting shrinks in Carb.
Before Carb. 3·00 inch
After " 2·45 -
or about 18 %. Feb 13th 1880
Chas Batchelor

Bast fibre shrinks in Carb.

Before Carb. 3·00
After " 2·23
or nearly 26 %.

Chas Batchelor

300 / 580 (.89
300
2800

Kittool fibre shrinks in Carb.

Before Carb. 3.00 inch
After " 2.42 "
or about 19%.

Chas Batchelor
Feb 13 1880

---

662 }
663 } Small loops cut from 10m Uncalendered paper after pressing under one man pressure Resis about 300 ohm.

Feb 13th 1880
Chas Batchelor

664 – Small loop – from pressed paper — about 300 ohms – coated with Zirconium Ox.

Feb 13th 1880
Chas Batchelor

this had a leak in inner tube and got no vacuum

665
666 } Same as 664 –
Feb 14 1880 C.B.

667 New pressed paper but high resistance

668 ~~New pressed~~ Old paper 6½ thousandths – R. 250

Experiments in Carbonization

Feb 15th 1880

Chas Batchelor

In our experiments with Bristol board we have been able to bring our loops both large and small to a resistance of 200 ohms using well calendered board of 9 and 6½ thousandths. As this board was known to be very impure owing to the clay, etc. and resins used in sizing we had some pure uncalendered paper made — This came to us varying in thickness from 15 to 10 thousandths — Large loops

made from the 15 thousandths
measured from 600 to 800 ohms
and small loops made from the
10 thoths measured 400 to 500
ohms. These high resistances
we thought must be due to
oxidization although we could
not see it direct — The loops
had not that peculiar
steel gray color that the
former ones had — This we
attributed to the absence
of that resinous matter that
is used in sizing the 'board'

/ We made a solution of resin in
alcohol and soaked some

1/2

of the loops in it (a weak solution) but these were 1500 ohms - In this case they really looked oxydised althoug the tissue papers did not —

2 We now put in 4 of the old style small loop and they came out 250 ohms showing that probably it is in the paper and not due to leakage in the moulds

We put the new paper under pressure but found not much difference —

We hammered the moulds so as to close the pores to prevent oxydising

3 loops brought from the hammered mould however measured 400 ohms

5 In the same mould that the old regulars came out of (250 ohms) we put 3 of the new paper pressed and they again came out 450 ohms with tissue paper looking splendid — Carbons looking very black and dull as they always have done

6 Same mould as above and double ~~strength~~ of resin came out 400 ohms

7 Same mould again and
doubled strength again
of resin - Came out beautifully
straight - but had a resistance
of 480 ohms

~~(3 loops new paper (pressed)~~
~~No 8 carbonized with cards~~
~~in between of same paper~~
~~pressed came out~~
~~275 Ohms these were~~
~~clamped down by a plate~~
~~of Nickel -~~
~~325 [illegible] 340 I think~~
~~the last on top~~

No 9 We now put 3 new (pressed) paper loops in with card between of same pressed paper (no tissue paper) and nickel plate to put on weight — These came out not very good shape but only 2.75 ohms

No 10. Three regular (new) pressed paper tissue paper — nickel weigh — 325 338 440

I think the last on top

Hammered mould

No 11 Three new (pressed) paper with extra double diabolically strong solution of resin in alcohol — tissue paper — ordinary carbon weight

325 — 315 other broke

No 12

Three new paper (pressed
– tissue paper – ordinary
carbon weight –
Came out 320 to 340 –
Boiled them afterwards in
solution of Sugar in Alcohol
with little water – Put them
on gas heater again –
Owing to putting in new
tissue paper the sticky
loop would not allow it
to shrink properly and it
broke up the loops

try Another

No 13
Took a piece of uncalendered paper 10 thousandths and soaked in creosote and Tar.— Carbonized it —

---

14 Bottom loop soaked in Tar and creosote
Bad looking 600 ohms

top loop soaked in sugar and alcohol
good looking (excellent)
142 ohms. make more

15 2 loops of regular paper - tissue paper - Carbon weight - put in fire clay mould - plenty of tissue paper packed in to keep it tight

16

3 Regulars for second boiling

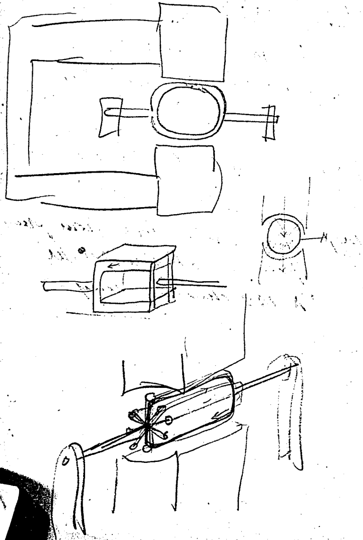
Lamps

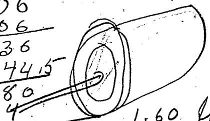
669 Old small loop made from
6½ M. - About 250 ohms —
Smoked by Camphor.

670 Same as 669 but not Smoked

671 New small loop from pressed
paper soaked in sugar
R 142 ohms — glossy —

Chas Batchelor
Feb 15th 1880



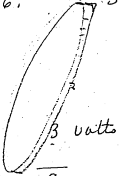


06
.06
.0036
4415
180
144
144
.16020
79
4
316.

1.60 ft lbs,
50
8,000

turns.

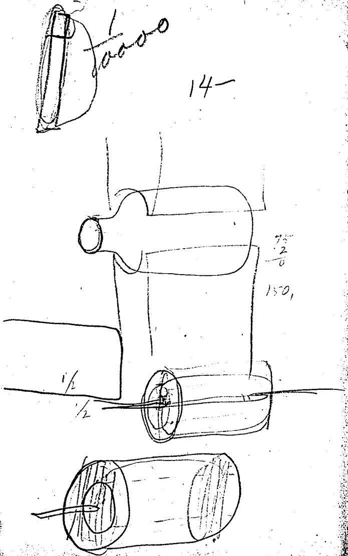
316.

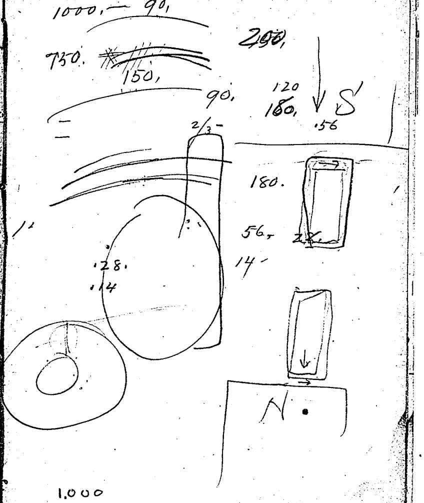


90 volts) 316. (3
270
46

3 volts,

9
44
396 · 2 · 1, ohm.
792 · 2 · 1/2 "
1584 · 2 · 1/4
3168 · 2 · 1/8
6336 · 2 · 1/16
12672 · 1/32


1,0000
14—
75
2
0
150,
1/2
1/2


1000,— 90,
~~200~~,
730.
150,
90,
120
~~180~~,
S
.56
2/3—
180.
56,
~~28~~
14—
.28.
.14
N
1,000

Carbonizing Feb. 16th 1880

Chas Batchelor

Exp 17 Tissue paper soaked
in boiling sugar in alcohol
and little water . part not
dipped in Sugar oxidized.
sugar part good worth more
trials between other sheets
to prevent oxidation

18 A small loop of new
pressed paper — the loop is
unfinished and of first cutting
— Soaked in boiling Sugar — dried —
— pressed from 13 M to 8½ M —
— carbonized — Stuck badly to the
tissue paper — Edison scraped it
clean — Dense — Vitreous
fracture

Carbonization Feb 16 1880
Chas Batchelor

19 Small loops new paper — Boiled in olive oill — after pressing ~~and cutting~~ — Dull looking — Not oxidized — 860 ohms —

---

20 3 New paper loops — small size — pressed — soaked in suga — pressed to ·008 M — cut out — carbonized — these had an ivory appearance befor carb.g. — after — 113 ohms — shiny — stuck badly to paper

Feb 16 1880
Chas Batchelor

21 3 small loops cut from 15 m paper after pressing to see what resistance

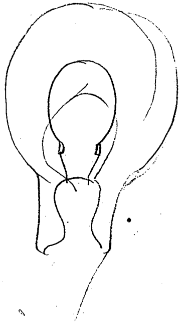
330 ohms

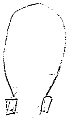
---

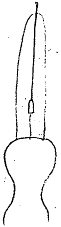
22 3 small loops of pressed new paper — soaked in sugar solution — cut and dried slowly — carbonized

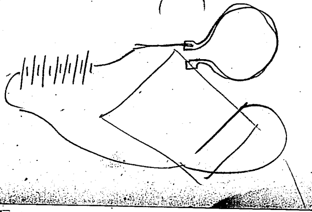
All broke by sticking together

Feby 7 1880









$\frac{1}{3}$ =

9 Expansions

6 = 11).100(.009 1 litre

10

8,500
6

1 14000. 7/1

36000 C.ON 1.4 grams

1 litre Q 34

7500 C

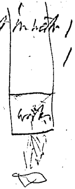
14 lb of water

8000

4-.4. 212

16

9-3/.5. } 100


1 cubic in water 1 ton
1 foot high
water

2.7

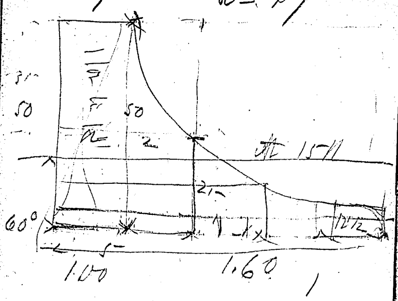
6 Expansion = 2,75 litres -

1 lb of water to 1 lb of air

=5.875.000 =

16000. 9 volts 3/5

$a^2 = xy$

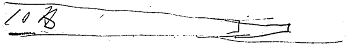

1
31
50
50
2
# 15 ll
2
60°
12½
5
1.00
1.60

260 / #

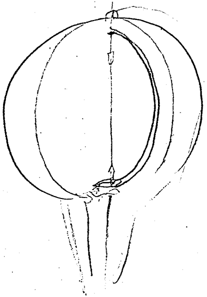
5,875 $\quad \begin{array}{r} 46 \text{ mills in } 8 \\ 46 \\ \underline{27} \\ 119 \text{ mills} \end{array}$

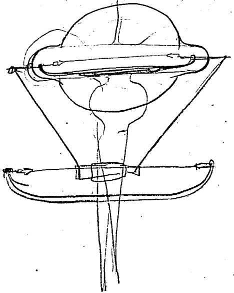
C $\lambda = 606.5 + .305\,t$

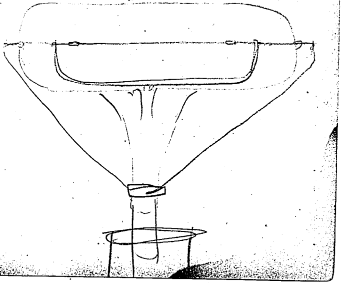
F $\lambda = 1123^\circ + 305\,t - 32^\circ$



2.3 gal = 33







1 Litre O

Grammes

15.4
1.4
616
154
21.56 Grains

6.1.3 cu in 21.56 Grams

61.3)21.65(.3.400 mg

61.3)1430.0(23
1226
210

.005

389
1500

5)200
40
1600

11

1/2

1.6
16
6

360)0100 0

360.)0010200003

1

16)100
96
4
644

1
10

.06240
0.640
14
2576
2576
3864
0041 4736
001036 84

po
16 .10
16
.039

3.1 4
4 12

32342

.003

100
309
.0032342

Lamps

642
643 } Small loops with Sugar
See carbonization Exp ~~Ex~~
No 20 Page, 126.
Feb 14th 1880
Chas Batchelor

674
675 } Carbonization Exp.
23 and 24 Page 134

676
677
678
679 } Carb Exp.
~~No 2~~ 25 and 26
Page 134

Carbonization   Feb 17 1880
Chas Batchelor

23   3 loops - small —
24   sugared before cutting

24 all stuck together.

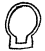
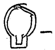
25   3 loops each small
26   sugared after cutting

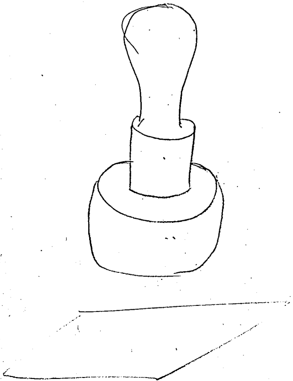
27 — Pieces of Bast fibre —
— Soaked in boiling Sugar —
— Bully! — very dense — boiled
in Sugar again — Carbonized —

Carbonization Feb 17 1880
Chas Batchelor

28- 2 Rings of Cocoa nut

---

29 Small loop - Sugared before Cutting — put in between 2 nickel plates — not cut off at bottom  — came out —  — very flat and nice



Carbonization · Feb 18th 1880 137

Chas Batchelor

30 Same as 29 only I cut the bottom so as to let two ends free

Busted, put in again —
Good looking

---

31 Same as 30

Came out very good
Not quite perfect in shape

---

32 3 loops (small) old style put in regular way — heated on gas jet only

For Dr Haid test for Hydrocarbons

Lamps   Feb 18th 1880

Chas Batchelor

680

Cocoa nut shell —
— too thick — 17.3 ohms

681 1 Small loop Exp. Carb.
No 29 page 136
93 ohms -

682 Same as 681 — Carb. exp. 30
683 small " " " " 31

Carbonization Feb 19, 80

Martin N. Force

83.

Ten strands of Jute Fibre Soaked in Sugar, placed in bottom of mould Six Strands on top Layer

Stuck together

(84)

Small bunch of Jute Fibre (Plain)

Came out beautiful

Carbonization Feb. 19. 1880

Martin N. Force

35
36
37 Regular-Paper (new) Cut in squares of an inch. Put in regular way heated on gas jet only

For test by Haid for Hydrocarbons

38 3 loops of Jute Fibre. several strands in each loop.

39 one Bast fibre loop 4" X .014

Lamps

684

685

686 —

687 = Bast fibre — 4in long X .014 thick
— Should be 100 ohms —

Carbonization Feb 18th 1880

Chas Batchelor

40 one bunch of very fine Jute fibres

---

41 One large ring of Jute fibres
One small ring of Jute fibres

---

42 One large ring of plaited Jute fibres

---

43 Bass fibre 5" $\overset{\text{in d.}}{X}$ ·014

Carbonization Feb 18th 1880

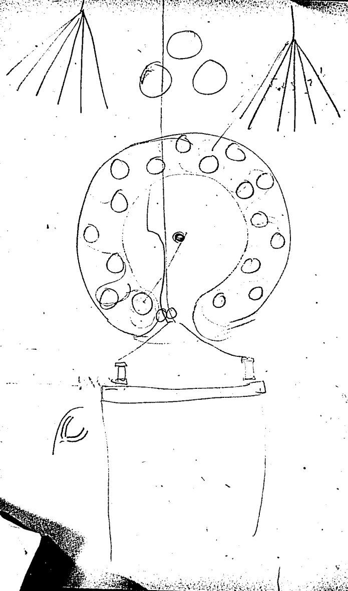
Chas Batchelor

44. Jute fibre — 3 strands plaited by Hipple —

---

45 Small loops — same as 32 —
Haid treated them with Nitro Muriate
acid —
all busted — try again —

46}
47} Bass fibre — 5 inch × ·014 ——



Carbonization

Feb 18 1880

Chas Batchelor

48 Jute fibre - Plaited 3 strands
by Hipple

---

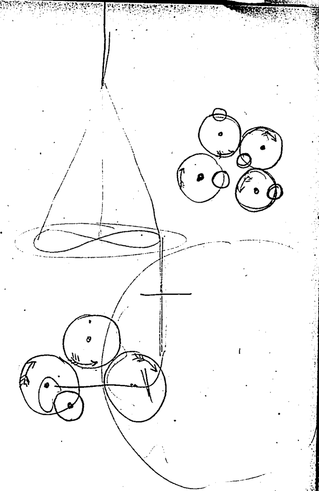
49 One Bast fibre 5in X .014

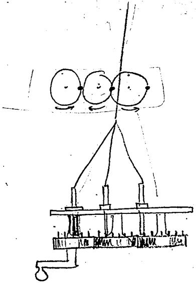
---

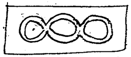
50 Jute fibre — 3 strands
twisted together by McKenzie —

---

51 Jute fibres — 3 plaited —







Lamps Feb 18th 1880
Chas Batchelor

688 - Bunch of fine Jute fibres see Carb. Exp. 40.

---

689 Bunch of fine Jute large Carb. Exp. 41

---

690 Small bunch of fine Jute Carb Exp 41

---

691 Large bunch of Jute fibre plaited 3 strands —

Lamps

692 Bast fibre~~s~~ — 5^{in} x ·014

695 Jute fibre — plaited 3 strands
693
695 Busted are in clamps
693 Busted

694 Bast fibre — 5 x ·014 —

695 Jute Fibre 3 strands twisted
together by McKenzie

Carbonization — Feb 18th 1880

Chas Batchelor

62. 3 large loops cut from 10 thousandth paper and soaked in weak solut of Sugar

---

53 Same as 52 —

---

54 2 Manilla hemp loops of 6 strands each of ·0015 thickness

---

55 2 large loops of 15 thousandths paper soaked in Sugar (thin sol) before cutting — no pressure at all — about 167 ohms

Carbonization —— Feb 18 1880

Chas Batchelor

56 = A lot of plaited Jute fibres different thicknesses —

---

57. 5 large loops from 10 M paper — Sugared in weak solution — before cutting — no pressing whatever —

---

58. Bass fibre — 5" x '014

---

59 3 large loops — 10 Thous^t paper Sugared in weak solution — before Cutting — no pressure —

Lamps - Feb. 19th 1880

Chas Batchelor

696 Bast Fibre..
5 inch X '014

---

697 Jute fibre - 3 strands plaited

---

698 } 3 large loops - uncal. paper -
699 } '010 inch thick - soaked in Sugar
700 } weak sol. before cutting —
Resis. after Carb. 169 ohms

701 large loop - Sugared in weak sol -
No pressure - put in large globe
busted by Francis —

Carbonization

60 3 moulds with 8 large loops in

61 One Bast fibre - 4 X ·014
This I boiled in water and made it set itself in position on cooling — so there is no strain in carbonization —

62. Plaited Jute fibres — soaked in thick sugar where the clamps catch it

Don
☐

Lamps Feb 20th 1880

Chas Batchelor

702 Bast fibre 5 X ·014

---

703 6 Manilla fibres ·002 thick — not twisted, but laid straight together —

this

---

704 }
705 } Bast fibre — 5 X ·014

---

706 — 717 inclusive
Sugar carbs about 200 ohms.

Carbonization Feb 20 1880

Chas Batchelor

63 — Jute fibre — plaited —
platinum wires fastened to Jute
by tying Jute round — these ends
boiled in Sugar —

---

64 Bass fibre — 5 × ·011 soaked
in sugar — shaped before
carb.

---

65 Underneath — loop of plaited
Jute — soaked in sugar — all over —

On top — loop of straight fibres of
Jute dipped in sugar and drawn
straight through the fingers

Carbonization Feb. 20th 1880 1528

Chas Batchelor

66

Bottom — Jute fibre plaited — wet and shaped by heat — ends cut off and sugared —

Middle — Thick plaiting of Ramie in ring — ends sugared — -Busted — stuck in mould

Top. — Thin plaiting of Ramie sugared all over — -Busted — stuck in mould —

---

67. 3 large loops — sugared with new sugar solution — made from 10 thousandths paper —

168.
2.00

Carbonization Feb 22nd 1880

Chas Batchelor

68. 3 loops-large — old sugared solution —

69. 3 loops large — new sugar solution

70 A small strip of birch bark

71 3 moulds of large loops — new sugared Solution —

Lamps Feb 22nd 1880

Chas Batchelor

718. Jute fibres — plaited — platinum wires fastened to jute by winding round with jute — ~~the~~ ends boiled in sugar — Carb. 63 —

---

719 Carb. 64. Bass fibre — 5 x .011 — soaked in Sugar — Shaped before carbonizing —

---

720 Carb. 66 Jute fible plaited — wet shaped by heat — ends cut and sugared —

Lamps Feb 22nd 1880

Chas Batchelor

721 Carb 62 — Plated jute fibres — soaked in thick sugar where the clamps catch it

---

722
723
724 } large loops cut from '010 — sugared in standard solution

---

725
726 Two high resistance large loops made from sugar sol No 0 —

726 broken by Glassblower

Carbonization   Feb 22 1880

Chas Batchelor

72 Bast fibres — thick — for investigation —

73 2 Bast fibres — held in — paper clamps — and clamps sugared

74 1 Bast fibre — Paper ends — ends soaked in sugar — clamp held in carbonizing chamber by piece of carbon slotted —

Carbonization Feb 22 1880 159

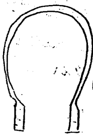
Chas Batchelor

75 1 Bass fibre — paper ends soaked in sugar —

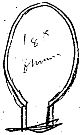
76 Four bass fibres. Spiral

77 March 3rd 1880
1 high resistance loop coated with sugar and plumbago solution —
36 ohms resistance

78 Piece tinfoil coated on one side with ~~thick~~ Sugar and plumbago —



New mould for Papers Feb 22 1880 C Batchelor



Sugar Solutions Feb 22 1880

Chas Batchelor

No 0 1½ oz Troy Sugar
140 cc Alcohol
47 cc Distilled Water

With 10 thousandth paper this makes carbons of 350 - 400 ohms.

No 1 1½ Troy oz Sugar
70 cc Alcohol
22 cc Water (Dist)

first lot 268 & 312 = too slow heat

Sugar Solutions Feb 22 1880

Chas Batchelor

No 2 1℥ Troy Sugar
70 cc Alcohol
22 cc Dist. H_2O

---

3 2 Troy ℥ Sugar
2℥
70cc Alcohol
22cc Water = Very thick on loops

Lamps Feb 23 1880

Chas Batchelor

727 Carb Exp. 74 — Bast fibre — Paper ends soaked in thick sugar —

728 Large loop — New Sugared Sol. — High R. 312 ohms —

729 large loop — Sugared with No 2 solution —

730 One large loop — coppered ends

Sugar Solutions

4 $1\frac{1}{2}$ oz Sugar
70 cc Alcohol
22 cc ~~H_2~~O - Water
— Water put in first till boils and alcohol added
— 230 R—

---

5 $1\frac{3}{4}$ oz Sugar
70 cc Alcohol
22 cc ~~H_2O~~ 1
— 157 - 169 - R

Sugar Solution

6 No 2 cards left in
20 minutes

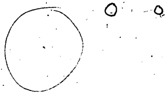
---

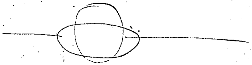
7 1 oz Sugar
50 cc H_2O
– loops boiled 25 minutes – blotted
between blotters —
190 – 197 – 177 – 200

---

8 2 oz Sugar
50 cc H_2O
blotted after
120 –

too low





16

731 }
732 } Large loops sugared with No 5 Solution of Sugar

733 Large loops. No 4 Sugar Solution

Large loops — soaked in No 4 Standard Solution —

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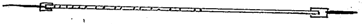
Bass Fibre –

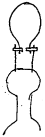
Feb 24 1880

Chas Batchelor

Make clamps so:–

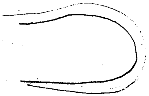


Take Bass Fibre and drill holes so:– Bring the whole up in Vacuo and then cut off into clamps putting fibres in so:–



It may be better to place the platinum wires in the holes before carbonizing

$\overset{\checkmark}{2} \times 2 \times 44 \div$



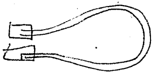
To be made immediately

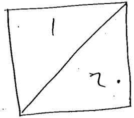
200 large loops sugared in Standard Solution

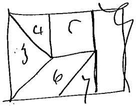
200 Small loops cut from 6½ in sugared and pressed

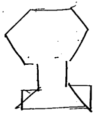
100 Manilla fibres of 8 in diam and long

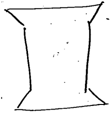
Have Kruesi make mould without cover so as to work in Vacuum

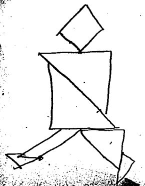












Test to see why some carbons are greater resistance than others in same mould

March 3rd 1880

No in Mould

Top. 1	2	3	4	5	Remarks
300	290	255	265	255	
204	216	300			top flat – 3 corrugated – 2 Slightly
249	316	327	—	—	all corrugated – 3 badly –
Broken	260	299	—	—	all flat.
206	208	238	—	—	all equally uneven –
	208	240			bottom most uneven
237	176	258	—	—	bottom uneven
202	192	237	—	—	1 & 2 flat, 3 corrugated
192	236	339	small loops		Bottom most corrugated
224	266	260	Small loops		" " "

Lamps.

773 }
774 }
775 }
large Carbons soaked in Edison's Sugar Solution Paper pressed first - Soaked - and pressed afterwards

---

776 large Carbon. - old solution Sugar (weak) - high resistance about 400 ohms - Coated with strong solution of plumbago and sugar - Sugar Coating not previously carbonized -

---

777 - One large loop - Edison new Sugar solution
775 -
777

Carbonization

79 – common paper with plumbago and sugar solution spread on both sides – dried – and ~~cut~~ came out all broken up

should have been put in without tissue paper

80 = three large loops –
Edison's sugar solution

81 =

---

82 5 thick tissue sheets –
– plastered on both sides with plumbago and sugar – and stuck fast together in cutting

---

83 – 22 tissue papers cut together

Lamps.

778 Old high resistance loop
- plumbago and sugar solution
- and carbonized (77) - Resis. 35 ohms
Busted in pump - inside glass
broke —

---

779 } large loops
780 } Edison's new sugar solution.
781 }
782 }
783
784
785

---

786 24 sheets tissue paper
cut together R 160
Glass cracked in pump
Carbon broke afterwards

24) 160 (20
20

160
24
640
320
20) 3640
182
3640

1820
227
12740
3640
3640
413140

1	3640
2	1820
4	910
8	455
16	227

18 $\frac{227 \times 1820}{227 + 1820} = \frac{413140}{2047}$ 2047) 413140 (20
4094
374

Carbonization—

84 24 tissue papers cut together
R 160 lamp 786

---

85 } 3 small loops cut from
86 } 15M paper pressed to 7M

---

87 22, Sheets tissue cut together
Busted

---

88 18 Sheets tissue Cut together

---

89 18 Sheets tissue Cut together
R. 285

---

90 18 Sheets tissue Cut together

Lamps

787 ~~Special Carbon~~ –
788 small loops cut from
789 pressed .015 paper

---

790 large loop.– Carb. No 89 –
18 sheets tissue pressed befor cutting
R 285

---

791 small loop. Carb No 96
R 270 – 12 tissue sheets pressed
together before cutting –

---

792 large loop – 18 sheets tissue
pressed and cut together – R. 254

---

793 3 small loops carb No 86
794 R 260. 260. 224 cut from 115 m paper
795 Pressed to 7 in.

Carbonization Mch 3rd 1880

91 18 Sheets tissue cut together after pressing

92 Tinfoil coated with plumbago and Sugar. and tissue paper stuck to it – carbonized between two plates – one recessed
came out all broke –

93 18 Tissue papers – pressed together
– large loop
R. 357 to high

94 12 Tissue paper – pressed –
small loop.

Carbonization

95= 9 tissues papers - cut = in small loops - tissues pressed together

---

96 12 tissues papers - cut together - small loop - pressed before - cutting -

---

97 18 tissues - large loop - pressed before cutting - weighted during Carbonization -

---

98 two moulds of 3 small loops 15 M paper (pressed and cut) uncalendered

Lamps Mch 3 1880
Chas Batchelor

~~Large loop~~
~~793 18 tissue papers~~

796 small loop cut from
797/15 m paper pressed to 7 m
carbnizg 86 K 285
86

---

798. Carb. 101 —
Small loop. (208 R.) 18 tissue
cut and pressed together

---

799 Carb. 99' (258 R)
12 Tissues cut together after
pressing

---

800 Carb. 103 (234 R)
Large loop
24 tissues pressed and cut together

Carbonization Mch 4 1880
Chas Batchelor

99 12 tissues - small loops
~~200~~ 258

---

100 18 tissues - large loop
cut together pressed before cut

108
101 18 tissues small loop
102 cut together Pressed ~~fa~~ before cut
102 Broken in taking out of mould

---

103 24 tissues large loop
cut and pressed be fore cut
104
105

---

106 18 tissues small loop
~~cuts~~ to gether after Pressed
all warped did not fit in

Lamps   Mch 4 1880
Chas Batchelor

801 (Carb. 100) R 270.
18 tissue cut and pressed together

---

802 Carb. 105.— 24 tissues cut and pressed together —

---

803 Carb 104
same as 802 -

---

804 (Carb 82.)
5 Sheets tissue paper coated both sides with plumbago and sugar and all pressed together

Carbonization Mch 4 1880

107 } large loop 24 tissues
108 }

107 540 ohms resistance

109 1 large loop of 22 tissues —

2 small loops 18 tissues —

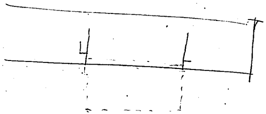
1 carbon weight and piece of nickel for extra weight.

110 1 large loop of 22 tissues.

1 small loop of 18 tissues

111 1 large loop of 22 tissues

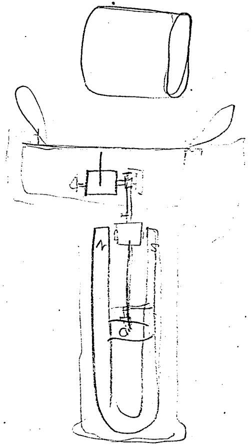
~~[illegible]~~



Mch 4 1880

Make thin bass fibres coated with plumbago and sugar and Copper plate the ends.

Have Geo. copperplate the carbons



Carbonization— March 4 1880
Chas Batchelor

112 3 Small loops of 15M un-calendered paper pressed to 7M

---

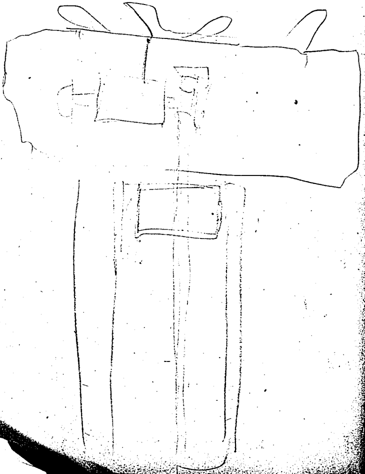
113 3 ~~Large~~ loops 22 tissues
114

---

115 2 moulds of Ramie fibres

---

116 2 large loops — of 22 tissues = pressed and Cut together



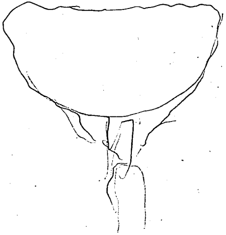
Carbonization Mch 5 1880

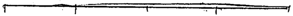
117 2 small loops of 12 carbon papers each

118 2 small loops of 18 tissues each— pressed and cut together

119 3 small loops of 15 in paper uncalend— pressed and cut together —

120 1 loops of (large) tissue papers 12 in number — with thin plumbago and sugar solution in between each —





Carbonization Mch 5 1880 186

121. Rammie fibres ~~together~~ ~~together~~ wet and drawn together

122 Manilla fibres about 12 together

123 2 Bass fibres coated with Plumbago and Sugar.

124 Jute fibres stuck together by wetting them in the mouth and drawing through the fingers

806
This I found broken n Glass house
I think by not washing
off the copperplating solution it had
~~eaten~~ broken out where the deposit ended
C.B.

Lamps Mch. 6th 1880

805 Small loop copperplated
15 m - paper pressed to 7 m
clamps heated on pumps and
busted

806 Small loop — copperplated —
'015 paper pressed to '007 —
broken in Glasshouse

807 Small loop - copperplated —
'015 paper pressed to '007 —
small crack on inside globe
cannot get vacuum

808 One fibre of jute with
coppered end
5000 ohms

100 | 8000
800

20
4
80

Carbonization

125 3 Manilla fibres coated with Plumbago and Sugar
So badly out of Shape that could not use them —

---

126 2 Jutes ~~fibres~~ of a number of fibres each set in Card holders

---

127 1 Full round fibres of wire grass — and
2 half round fibres of same.

---

128 3 fibres of ~~brown stringy looking~~ ~~fibre~~ brought by Dad
palmetto leaf fibre —

Carbonization = March 6th 1880

129 Palmetto leaf fibres -

130 2 Moulds of 3 small loops each - .015 uncal. paper soaked in NH_4SO_3 and pressed with hard pressure

131 Palmetto leaves split to width
oxidized try again

132. 4 Small loops - uncalendered paper soaked in NH_4SO_3 & pressed -

133. lot of fibres taken from stuff from Palmetto leaf. that looks woven -

Lamps

809
810 } 2 Small loops — '015 uncal.
paper pressed to '007 — ends.
copperplated

811
812 Manilla fibre — ends copperplat
— Carb.exp. 122 —

---

813 3 Small loops '015 uncal. paper
814 pressed to '007 — ends copperplated —
815

---

816 Jute — (fibres) number —
(Carb 126) Coppered.

Carbonization

134 24 Manilla fibres '007 thick - picked - perfect.

---

135 2 threads in platina clamps.

---

136 large loops - treated with phosphorous

---

137 4 moulds of small loops made from uncal: paper '015 pressed to '007 after soaking in NH_4SO_3

817 Bass fibre coated with Plumbago and Sugar – (Carb. exp. 123) Coppered –

818
819 } Manilla fibres – Coppered –

124
820
821
822 Jute Fibres stuck together by weighting them in the mould and drawn through the fingers
carb 124

C 133
823
824
~~825~~
825 } Palmetto leaf Carb 133

'04

8 / '20
'025
'050

16 cells. '2

2 cells of 8. =

Mch 6th 1880
Chas Batchelor

826 Wire grass - Carb. 127 -
- copperplated - very brittle
- Busted at top soon as put on -

c.130

827.
828.
829.
830.
831.
832.

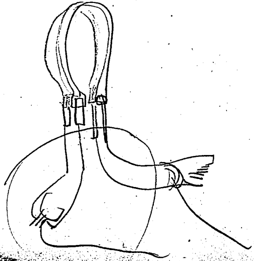
Carb. 130
Small loops - '015 paper soaked in Sulphate Ammonia pressed to '007 - coppered

gone up

lasted 10 minutes at 1 gas jet

833. Palmetto leaf fibre -
- coppered -

Over



Carbonization Mcl 1880

138. 2 fibres (Manilla) together but kept apart

---

139 Moulds of '015 uncal. paper soaked in Sulph NH4 and pressed to '007 —

---

140 2 Moulds of '015 uncal- paper pressed to '007 — These must be treated with Hydrofluoric acid

---

for further Carb. Exp see book 57.

6 × 6 × 44 ÷ ·1 ÷ ·05 = ~~100~~ ·15

36

264

132

1584 ÷ ·15 =

·15 | 1584·00 | 8 | ·20

3 | 10560 | ·025

3520

·05

8 × 8 × 44 ÷ ·05 × 4 + ·05 = ·25

64

176

2816

·25 | 281600

25 | 11330

453

2265

4 × 4 × 44 ÷ ·025 + ·05 = ·075

·05 + ·05 = ·1

16

264

44

·03 | 70400

23500 | 7 | 704~~00~~

7833 | 3520

2666

Lamps

834	Cart 134 Manilla fibres - about ·007
835	- Coppered -
836	
837	
838	

839	Cart 137 Small loop uncal. ·015 paper
840	Soaked in Sulphate Ammonia and pressed to ·007 — Coppered

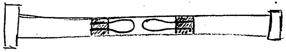
↓

Cracked in glass (inside) busted in 5 minutes

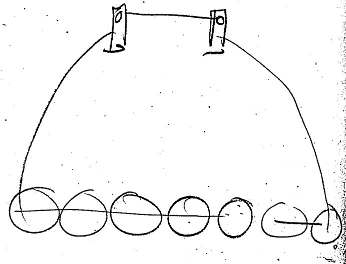
---

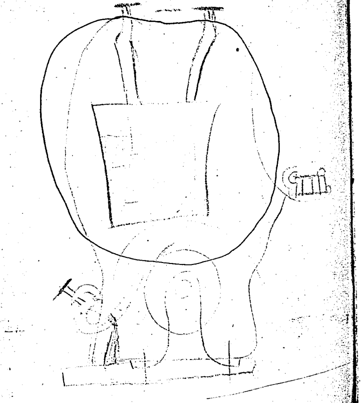
for further Lamps see

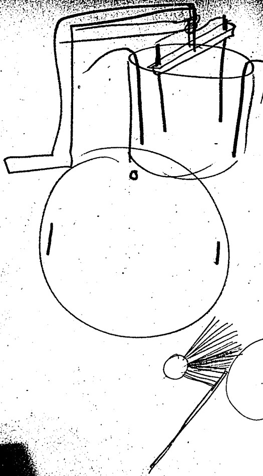
Book 57



HD rubber disk





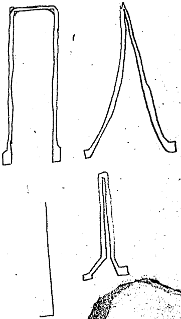


10
30
15

$$W = \frac{5334 \times \overset{6}{HP}}{\underset{2500}{V} \times \underset{1.25}{C}} = W = \frac{5334 \times 6}{2500 \times 1.25}$$

625
3125

3125) 26670 (84
25200
14700



25
15
40
12
480

12250
12250
2000
28500
6000
5550

25
12
300

15
12
180

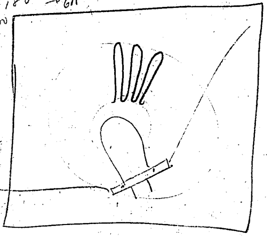
~~6000~~
60

400 400

~~6000~~ 6
~~56~~
360

15
12
180

25
180
5500



5500

3500
2000
1500

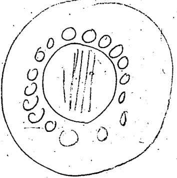
'22

'0005
3.1
0.05
15
.0155
18
1240
0155
0.279

.0155
.0310
.2~~4~~80

.0155 14
.0310
.2170

46
8
2~~1~~468
12341
3

40 : 8
3